Outpatient Management of the Asthmatic Child

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ANY physician serving large numbers of children will be called upon to manage many with asthma. During the past few years, information has become available regarding both, the etiologic factors associated with asthma and the mechanism of drug action in reversing the symptoms. Our discussion relates primarily to the management of the child with asthma. We will touch briefly on the pathophysiology, discuss some treatment modalities and finally, suggest a general protocol which may be used as a guide in managing children with the varied clinical spectra of asthma.

PATHOPHYSIOLOGY

Asthma, as a pathologic process, involves change in the terminal bronchiole. Components of the disease include mucous plugging, mucosal edema, and bronchospasm.

Mucous plugging ultimately results from hypersecretion of the glands that surround the bronchi and bronchioles. When this mucous drys, it becomes thick and tenacious. The plugs that form obstruct the small airway and intensify the work of breathing.

Bronchospasm is reflected by varying degrees of respiratory difficulty and wheezing. It is important to realize that significant bronchospasm must be present before respiratory difficulty or wheezing becomes clinically apparent. Although wheezing is always a sign of significant bronchospasm, bronchospasm with wheezing does not always represent asthma. This problem exists as a component of several pathologic processes which include:

1) Foreign body
2) Diseases of the lung parenchyma
   a) bronchiolitis
   b) pneumonia
   c) bronchiectasis
   d) cystic fibrosis
3) Pulmonary anomalies
4) Aortic arch abnormalities
5) Trauma to the laryngotracheal area

The possibility that a patient does not have asthma must be considered in any child who presents with wheezing for the first time.

Present thinking suggests that bronchospasm results from a relationship between the classic IgE mediated allergic reaction and the autonomic nervous system.

IgE antibody develops in response to exposure to specific antigens in susceptible individuals. Some of the more common antigens are listed in Table 1. Once the antibody forms, it circulates in the serum and ultimately finds its way to the surface of mast cells throughout the body. When the patient is subsequently exposed to the antigen, it combines with this IgE antibody. The reaction results in the release of allergic chemical mediators. These substances are released in various locations throughout the body causing vascular permeability, vasodilation and bronchospasm. When these reactions occur in the lungs in significant quantity, asthma results.

The principal allergic mediators are hista-

mine and slow reacting substance of anaphylaxis (SRS-A).

Increasingly, the role of the autonomic nervous system has been demonstrated to play a substantial role in the development of asthma. The lung itself is innervated by a number of adrenergic and cholinergic fibers. The adrenergic fibers are both alpha and beta in type.

Table 1. ANTIGENS

Inhalant	*Non-Inhalant*
Pollen	Foods
Grasses	Drugs
Trees	Insect Venom
Weeds	
Non-Pollen	
Molds	
Animal dander	
Dust	

Generally, alpha adrenergic stimulation causes bronchoconstriction and beta adrenergic stimulation reverses bronchoconstriction. Szentivanyi proposed that asthma can result from an imbalance in the relationship between alpha and beta fibers.[1] The cholinergic fibers are also thought to participate in the development of certain types of asthma. Exercise induced asthma and certain types of conditioned responses are probably mediated through the vagus nerve. For a more detailed discussion of the nature of these mechanisms, we refer you to our previous article.[2]

THERAPEUTICS FOR THE ASTHMATIC CHILD

Any therapeutic regime for managing children with asthma must include hydration, specific medical therapy and environmental control.

Hydration. Adequate hydration is as important for the proper control of asthma as any pharmacologic agent. Every child with any history of asthma must be conditioned to drink 2-3 times the amount of fluid usually desired during the day. This conditioning process should begin as soon as the diagnosis is made. The insensible fluid lost during the initial hyperventilation associated with asthma may be subtle but significant. This drying out process may facilitate mucous plugging. It is our feeling that careful, daily attention to fluid management can reduce the morbidity in childhood asthma.

Specific Medical Therapy. The list of new drugs available for the treatment of asthma grows longer every year. Any approach to conventional therapy should include the use of antihistamine, bronchodilators, steroids and cromolyn.

Antihistamines. The use of antihistamines in asthmatic children has been condemned in the past. In theory, they should be valuable in counteracting the effect of one of the principal allergic mediators—histamine. However, they do dry secretions and possibly, aggravate the patient with asthma. Practically speaking, some small children with pollen allergy do respond to antihistamine. But, generally, they are not effective in reversing bronchospasm.

Bronchodilators. Bronchodilators come in several forms—tablets, suspensions and aerosols. They are available as single drugs or as combinations. Several studies allude to the fact that combination therapy is no more effective than single drug therapy.[3]

Classification of bronchodilators is based on their affect on the adrenergic nervous system and their relationship to the generation of Cyclic 3-5 AMP, the physiologic bronchodilator.

1) Drugs which stimulate Cyclic 3-5 Amp production
   a) epinephrine
   b) ephedrine
   c) isoproterenol
   d) metaproterenol (Alupent)
2) Drugs which prevent the breakdown of Cyclic 3-5 AMP
   a) Methylxanthines—theophylline, aminophylline

Table 2 lists some of the more commonly available bronchodilators.

We have listed a few principles to follow in using bronchodilation.

1) Start with single drug therapy. We generally use a methylxanthine such as theophylline or aminophylline. Combination drugs are difficult to evaluate in terms of which component is having the most effect or is responsible for side affects.

2) Use enough of the medication. We usually dose our patients with reference to the theophylline composition in any drug. We use 4-5 mg/kg/dose of the theophylline in the drug preparation.

3) If there is doubt concerning the dose therapeutic relationship with a theophylline containing preparation, theophylline levels drawn 1½-2 hours after the ingestion of the medication may be helpful. Optimal therapeutic plasma concentrations for orally ingested theophylline range between 10-20 ug/ml.

4) Nebulizers are to be avoided whenever possible. Most contain isoproterenol or combinations of isoproterenol and epinephrine. They can be extremely effective and herein lies the disadvantage. Children tend to over use them and are likely to over-medicate themselves. Excessive use of isoproterenol has been associated with significant morbidity and mortality in children. One alternative to isoproterenol by medihaler is metaproterenol (Alupent). It appears to be as effective as isoproterenol, its affect lasts longer and it has a wider margin of safety. If an older child requires medihalers for control, we have had great success with metaproterenol.

Table 2. BRONCHODILATORS

Theophylline	*Combination forms**
Aerolate Sr.	TEP
Aerolate Jr.	Tedral suspension
Asbron	Marax suspension
Quibron	Tedral tablets
Elixophylline suspension	Marax tablets

*Contains Theophylline and ephedrine and / or Phenobarbital and atarax.

Steroids. The action of steroids on the pathology of asthma is not completely understood. Generally, they are felt to have some affect on adenylcyclase and histamine metabolism.

The use of steroids has a definite place in the treatment of asthma. Our criteria for initiating steroid therapy in children is: Children who are on adequate doses of bronchodilators (5-6 mg/ kg/dose every 4-6 hours) who are still significantly symptomatic daily. Our usual regimen includes:

a) A four to five day course of a short acting steroid such as prednisone at approximately 1 mg/kg up to 60 mg. p.o.

b) The dose is divided such that ⅔ is given in the AM and ⅓ in the PM. That is, a dose of 30 mg of prednisone is divided into 20 mg given in the morning and 10 mg given at night.

c) At the end of the initial treatment period, the child is re-evaluated for one of two possible courses: 1) discontinuance of steroid therapy if he or she is clinically improved; or 2) alternate day steroid therapy at the same total daily dose if significant symptoms return within 24-36 hours after discontinuing the steroid therapy. Steroids are most effective in treating asthma. The side affects of chronic steroid therapy are well known. They must be used with caution and in a appropriate manner. On the other hand, failure to use steroids when there is proper indication, leads to unnecessary morbidity in children with moderate to severe asthma.

Cromolyn Sodium. Disodium cromoglycate, referred to as cromolyn sodium or Intal (Fison), has been available for use in this country for the past two to three years. This drug is thought to prevent histamine release from the mast cell.[4] Cromolyn is not helpful during an acute attack and may aggravate the patient. It should be discontinued.

It is helpful in controlling some patients who are on high dose bronchodilator therapy and/or steroids. In these instances, it may allow the clinician to reduce the dose of both. The usual dose is 20 mg by capsule and nebulizer, t.i.d. or q.i.d. Some children respond dramatically to cromolyn, others not at all. A trial of several weeks may be necessary to determine its effectiveness for any one patient. If there is no change in the patient's clinical condition after this period, the medication should be discontinued.

Immunotherapy. A discussion of drug therapy is not complete without some mention of immunotherapy or "allergy shots". Immunotherapy is a process by which allergic antigens are injected into sensitive patients at progressively increasing concentrations. Hopefully, by means of this method, sensitivity to those antigens is reduced.

As a general rule, allergy shots are instituted if medical therapy and environmental controls do not result in satisfactory control.

Immunotherapy is most effective in symptomatic patients with positive skin test to pollen allergens who are most symptomatic upon exposure to those antigens. Immunotherapy is drug therapy. Reactions to the injection, while uncommon, do occur. The form of treatment is costly in terms of both time and money. It should not be used in asthma as front line therapy. However, in asthma under the conditions we described above, immunotherapy has been demonstrated to facilitate the reduction of symptoms as the patient gets older.[5]

Environmental Control. Avoiding exposure to known allergic triggers for the asthmatic child is a most effective way to control symptoms. This is a rather easy matter for patients who are allergic to certain foods, drugs or animal dander once they have been identified as causative. Dust controls must be aggressive to be effective, especially as they involve the bedroom, where the child spends ⅓ to ½ of his time. A pillow casing, a mattress cover, no rugs or dust collecting items such as books, stuffed animals or toy models can reduce symptoms significantly in dust sensitive patients with asthma. Avoidance of pollen antigens are generally not effective.

Environmental control must be tailored to meet the needs of the patient and his family. We are always careful to inconvenience the child as little as necessary for adequate control. Generally, a change of geographical environment, while often resulting in a transient reduction in symptoms, will not alter appreciable the nature of asthma. It should only be suggested, if ever, under desperate circumstances.

MANAGEMENT OF THE CHILD WITH ASTHMA

We have discussed some aspects of the pathophysiologics in asthma and some of the specific treatment modalities available. What follows is a protocol which attempts to use that information as a guide to management of asthmatic youngsters. We emphasize that this is a way to manage these children with varying degrees of symptoms, not *the* way. We feel that a structured and continuous protocol for managing asthmatic children results in the reduction of unnecessary morbidity and mortality.

Any rational approach to therapy must take into consideration the clinical condition of the patient. The treatment regimen must never become more of a problem than the disease itself. We utilize the concept of the "effective minimum" in therapy. We consider each patient individually and design a management protocol tailored to meet the needs of the child.

Conceptually, asthmatic patients in our practice are classified into mild, moderate or severe categories, based upon frequency of attacks and episodes of status asthmaticus requiring hospitalization (Table 3).

Table 3. CATEGORIES OF ASTHMA

Classification	*Frequency of Asthmatic Attacks*	*Hospitalizations*
Mild	Several episodes of wheezing per year	None
Moderate	Several episodes of wheezing per month	Few
Severe	Wheezing daily	Frequent

Generally, the *mild asthmatic* can be managed with: 1) adequate hydration and 2) oral bronchodilator—4-5 mg/kg/dose of the theophylline/dose every four to six hours.

Children in the category "mild asthma" usually respond to simple measures. Much of the time, these attacks are proceeded by fever or chronic cough. If this is the case, then it might be a good idea to have the patient start the bronchodilator when these symptoms occur. It is our impression that these children do better when treated for three to four days once the problems start, rather than p.r.n. If the attacks become more frequent than stated above, we consider the patient now has "moderate asthma."

Moderate asthma is initially managed with the use of: 1) adequate hydration; 2) oral bronchodilator therapy in the dose mentioned above but continuously every four to six hours until 24-36 hours after the patient appears to be asymptomatic. If the patient cannot tolerate theophylline, we will generally try; 3) metaproterenol suspension (Alupent) alone or in combination with a reduced dose of theophylline, 1 tsp. p.o. q.i.d. if less than 60 pounds but greater than 35 pounds. Two tsp. p.o. t.i.d. if greater than 60 pounds; and 4) com-

bination bronchodilator therapy with Marax, Tedral, or Quadrinal, still with dose based upon theophylline content.

If the child continues to have several significant attacks per month we will generally attempt: 1) a trial of Cromolyn (Intal), 20 mg by spinhaler t.i.d. or q.i.d. between attacks; or 2) five day course of prednisone at 1 mg/1b up to 60 mg. Children who do not respond to this regimen must be considered as "severe asthmatics."

Severe asthmatics must be seen as often as they are still symptomatic. This might mean daily. Generally, they have been managed with: 1) hydration; 2) oral bronchodilator therapy—theophylline in the doses mentioned; 3) metaproterenol p.o. alone or in combination with theophylline; 4) steroids 1 mg/lb daily only as long as is necessary to control symptoms. Then they are switched to alternate day therapy; 5) sub Q epinephrine at home for periods when they are symptomatic in spite of the above measures. Generally, we will give epinephrine:

Children between 20—35 lbs	0.1 cc epinephrine
35—60 lbs	0.2 cc epinephrine
60 lbs+	0.3 cc epinephrine

We seldom use more than 0.3 cc epinephrine. We teach parents to use it at home with the insistence that we be called whenever it has been given; and 6) Isoproterenol & Metaproterenol (Alupent) by medihaler one to two sprays every three to four hours prn severe wheezing.

If severe patients stabilize, all medications except theophylline and alternate day prednisone are discontinued. We will generally attempt to reduce the steroid dose to ⅔ of the original level. If the patient does not become symptomatic, we will usually try to start cromolyn and further reduce the steroid dose.

Most moderate to severe asthmatics will be referred for skin testing by a doctor experienced in these procedures. Appropriate environmental controls are instituted and, if indicated, immunotherapy is begun.

SUMMARY

The child with asthma poses an interesting and challenging medical problem for the physician. A guide for classifying and managing has been presented. We emphasize that our method is not the only method. However, we do feel that some understanding of the pathophysiology and familiarity with specific treatment modalities is essential in planning an effective therapeutic course for any one child. A structured and continuous approach to the problem encountered by children with asthma and their families will result in a reduction in morbidity. This will be a rewarding experience for the physician and parent alike.

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